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ABSTRACT

A study examined the condition of equipment used in secondary and adult vocational education programs in Ohio. Data were collected concerning the educational equipment used to provide vocational education in 19 subject areas by 41 selected schools throughout Ohio. The principal sources of data for the study were an inventory questionnaire, site visits, interviews with local business and industry personnel, and a literature review. The status of equipment varied widely by school as well as by program, with the greatest need for equipment being evident in smaller vocational districts where officials have trouble passing levies. It was recommended that policies, procedures, and resources be developed to provide, install, and maintain state-of-the-art equipment and accessories needed for vocational education, including equipment for assessment laboratories and service to disabled individuals. Practitioners were urged to adjust curricula and individual programs to provide needed instruction in the use of computers and to explore the possibilities of making more flexible and efficient use of equipment through competency-based instruction. The multiple use of assessment laboratories by related schools was encouraged. It was suggested that high school and postsecondary vocational institutions develop and implement plans for articulation between the institutions in the use of facilities and equipment. (The inventory questionnaire is appended.) (MN)

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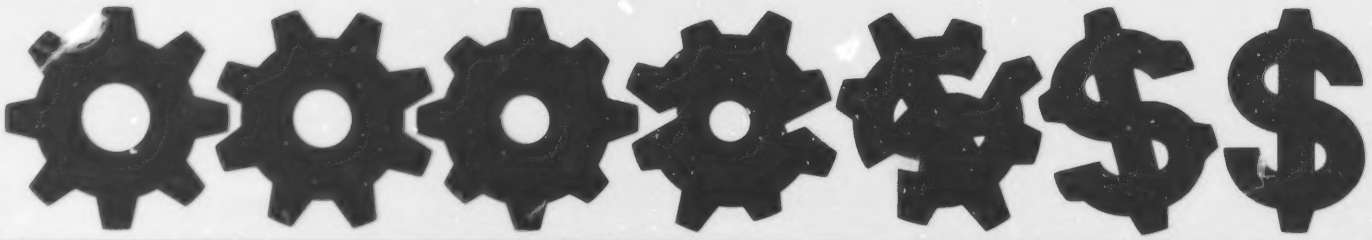

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Vocational Education EQUIPMENT In A Changing Economic Era

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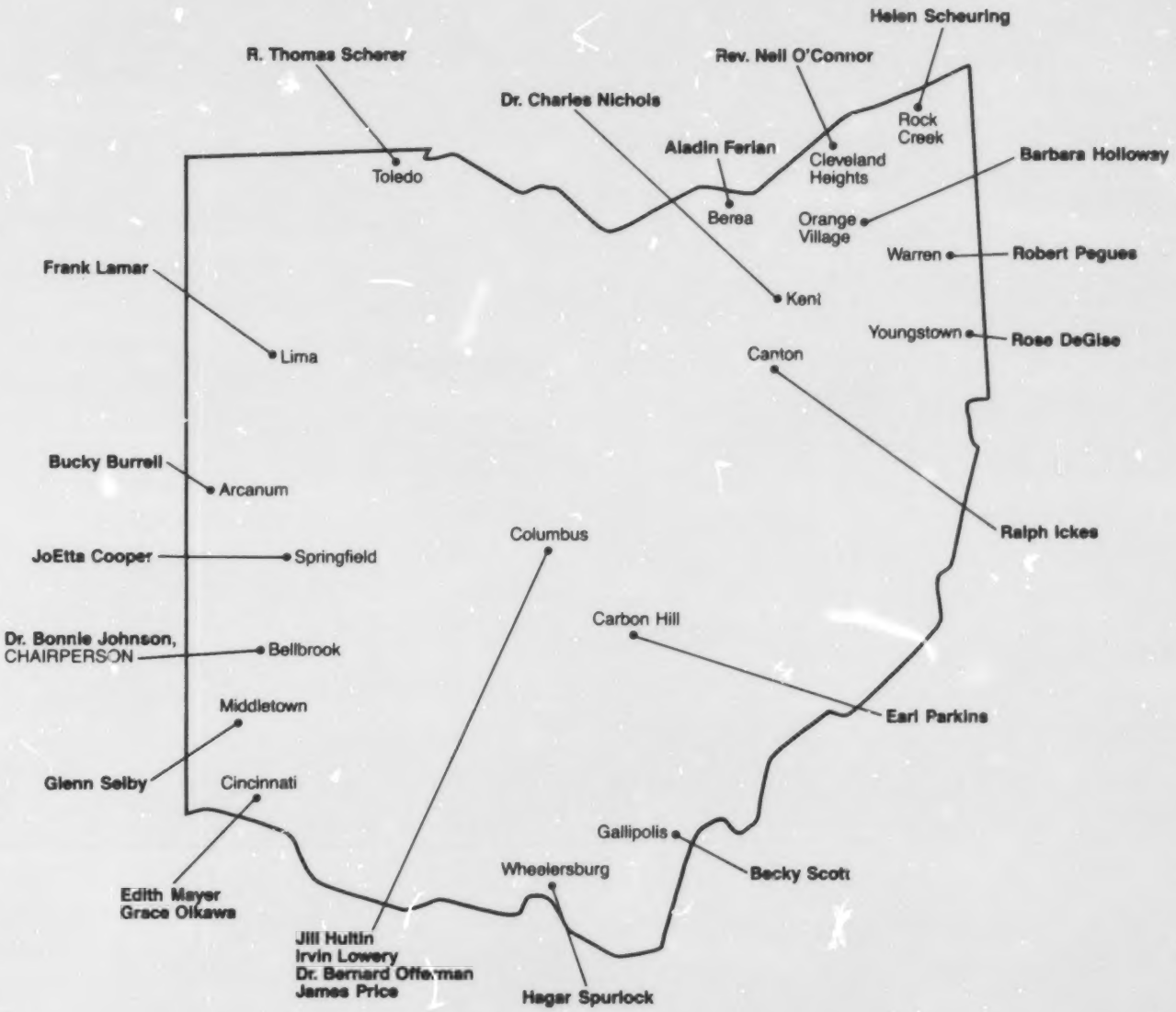

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FOREWORD

The primary purpose of this study was to ascertain the status of equipment used in Ohio programs of vocational education. Special concern was directed to equipment used, additions needed and funding in the current changing economy. Dr. Lester W. Huber conducted this research for the Ohio Advisory Council for Vocational Education.

Evaluations were made in 41 school districts which were recommended as having good programs. Emphasis was placed on 19 programs in which equipment is a critical aspect of the instruction. The condition and adequacy of the equipment varied among the schools and programs. Generally, the small schools and largest cities were in greatest need. Two major areas of need existed in the replacement of expensive equipment that was worn out or obsolete and that which is needed because of changing technology. Cost of the present equipment ranged from $10,475 to $235,724 per program. Current prices would be considerably higher. Equipment costing less than $300 per item was not included. Suggestions made by the school personnel for additional needed equipment ranged upward to $150,000 per program. Installation and accessory costs were found to be very relevant in purchasing equipment. Provisions for equipment to be used in assessment laboratories and in serving the handicapped are a growing urgency.

Among the recommendations it was proposed that policies and procedures be developed by the school districts to provide, install and maintain state-of-the-art equipment. More financial assistance from the State Legislature should be sought. Curriculum adjustments are necessary to provide instruction in the use of computers and additional mathematics, science, and communications as related to a changing economy and use of sophisticated equipment. Articulation with postsecondary institutions, use of advisory committees and in-service programs for counselors and staff in vocational education were proposed as urgent needs.

Bonnie Johnson
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PERSPECTIVE

Broad Purposes of the Study

The primary purpose of this study is to ascertain and report the condition of equipment used in Ohio programs of vocational education in teaching both secondary school and adult students. Concern is given to the kinds of equipment used, what is needed, and the problems in obtaining it for the shops and laboratories of the public schools.

A related purpose of the study is to identify some of the conditions and influences in our changing economy which bear on the types of equipment needed to meet the vocational demands of the present and the future.

This study effort should provide worthwhile information to the State of Ohio Department of Education, administrators and teachers of vocational education, high school counselors, boards of education, advisory committees, the general public, and state legislators who need such information for planning purposes.

Specific Purposes of the Study

The more specific purposes of the study include:

1. To observe equipment in many programs, in addition to that which is inventoried and reported for selected schools, to ascertain generally the state of equipment.
2. To provide specific illustrations of equipment used and that which is needed in schools to provide bases for understanding the extent of equipment needed in vocational education programs to meet employment needs of high school and adult students.
3. To ascertain further financial support which may be needed for equipment.
4. To secure comments and suggestions from teachers and administrators concerning equipment as it relates to effective vocational education.
5. To call attention to the fact that we are in an era of a changing economy and that the technologies of these times require some different kinds of equipment.

6. To confer with employers in business and industry to better understand their needs as they hire job entry people.

7. To review the literature concerning new developments in business and industry and to ascertain vocational equipment needs in Ohio and other states.

8. To make meaningful generalizations and recommendations to the Ohio Department of Education and others concerning vocational education equipment.

Procedures Followed

Selecting the Schools and Program Areas

Personnel of the Division of Vocational Education of the Ohio Department of Education, The Ohio Advisory Council for Vocational Education, and other knowledgeable vocational educators, advised the writer in the selection of the nineteen service areas in 41 selected schools throughout Ohio. The 19 areas selected were programs in which equipment is a critical aspect of the vocational instruction. They include Accounting, Agricultural Mechanics, Agricultural Production, Auto Body, Auto Mechanics, Child Care, Cooperative Office Education, Cosmetology, Data Processing, Drafting, Electricity, Electronics, Food Service, Graphic Arts, Machine Shop, Merchandising, Stenography, Welding, and Word Processing.

From the suggestions, 3 programs were chosen in each of the nineteen areas for special study. Consideration was given to geographic balance and representation from local, village, small city, joint vocational and large city districts.

Questionnaires

An inventory questionnaire, a copy of which is in the appendix, was developed to collect data about present equipment used in the school shops and laboratories in the 57 programs. No equipment valued at less than $300 was to be reported. In addition to the inventory of equipment, information was solicited on the cost of present equipment, its replacement value, and other equipment needed. The extent of adult use of the equipment was reported.

Visits to Secure Additional Data

Visits were made by the writer to 41 school districts to observe in particular 57 programs, and to visit in general hundreds of other programs representing most of the program areas offered by vocational education. Teachers and administrators participated in the conferences and provided information, including many ideas and concepts concerning vocational education.

Interviews with Business and Industry Personnel

Interviews were conducted with selected business and industry personnel to secure their points of view concerning vocational education with special emphasis upon the importance of equipment and related problems. They appeared to be anxious to volunteer their desires about the kind of personal characteristics, vocational skills and basic academic learnings needed for job entry.

Literature Study

Literature was studied which related to the changing economy to ascertain the kind of equipment needed to prepare job entry persons. Another phase of the literature search was to identify related studies or developments made in other states.

SECONDARY VOCATIONAL EDUCATION IN OHIO

History and Circumstance

Although vocational agriculture, home economics and some trade and industrial programs have been popular in Ohio for many years, other secondary vocational education evolved slowly in the '50s and '60s. During the '70s most vocational programs in Ohio were in place or were in later throes of being put in place. By the 1982-83 school year there were 148,489 secondary students in vocational programs in Ohio, more than 40% of all high school juniors and seniors. Between 1977 and 1981 of those completing the courses 90.8% were employed, and 9.2% were unemployed. In 1981, there were 56,163 secondary school completers.[11] Such figures readily show the growing importance and the significance of secondary vocational education in Ohio.

At the present time all Ohio School Districts provide the opportunity for vocational or technical education to their students. Some larger districts have self contained programs, while other districts have cooperative arrangements or belong to Joint Vocational School Districts. After completion, the students may enter the workforce or may continue their vocational or technical education in one of 46 associate degree programs in Ohio, or in a college or university.

It is of interest that the high school retention rate (which means that students who complete the fifth grade, complete high school) rose from 53% in 1957 to 79% in 1981.[11] It is the conviction of many people that the opportunity for students to take hands-on education had a definite influence on this holding power. It is also contended by some that hands-on opportunities have saved some goodly number of youth from purposelessness or from idle ventures. In 1980 it cost $2,032 for a year of vocational training in an effort to graduate an adjusted, happy producer who would help build our society rather than being a person who would become a drain on it.[11] In the same year it cost nearly three times that amount to maintain an incarcerated person who ran afoul of society.

Adult Programs Use Facilities and Equipment

Most adult vocational or technical students who enroll in Ohio school district programs train on the same equipment that serves the in-school population. Adults participate in short-term programs or in long-term programs. Some of the larger Ohio school districts provide some solely adult facilities and equipment. Those same districts conduct training programs in business or industrial facilities, upon special request of the cooperator.

In 1982, for instance, there were 329,190 long-term, short-term, apprentice and home-making adult students in Ohio public school vocational or technical classes.[11] Most of these were either in training classes for job entry or in retraining classes for up-grading of skills. Of the completer adults approximately 6% proceed to higher education courses.

Need for Updating Equipment

The status of equipment varies from program to program and from school district to school district. Through consultation and visitation it was found that equipment ranges from very old to modern. Sometimes the extremes are found in the same laboratory because replacement has been so slow. In a few of the schools the equipment is consistently outstanding. It would have been possible to list only equipment found in these schools, but that would not have been representative of the State of Ohio.

When vocational courses were begun, some of the machinery or equipment in comprehensive education districts was transferred from industrial arts classes. Some of this equipment is of World War II vintage. Such machinery is no longer found in use in the average factory or business. On our visitations we were told that when equipment in homes, offices or plants is better than in schools, students become discouraged.

Loans or gifts of equipment from businesses or industrial firms also comprise a part of present equipment. It has been very much appreciated. In general, however, those pieces were the ones being taken out of use by those companies. Those pieces of equipment quite often do not represent modern methods of operation, but is is also true that students entering the job market may use such equipment on their first jobs because machinery in shops often changes slowly. H.A. Hunt and T.A. Hunt point out in the Michigan study entitled "Robotics", that even "after 25 years, only 3 to 4 percent of all metal cutting machine tools are numerically controlled. . . . In terms of actual application, all process technology changes are evolutionary rather than revolutionary because there are physical, financial and human constraints on the rate of change. . . ."[5]

The third kind of equipment found in the various laboratories and shops is that which was purchased when the vocational program began, generally bought with bond issue money designated for that purpose. It was the best equipment that could be obtained at that time with the available money. The problem now is that those pieces are, on an average, ten to fifteen years old and do not meet present needs, or they are worn out. Quite a number of machines stand idle for lack of repairs. It is not generally understood that a machine, such as a typewriter, that is used all day and much of the evening, has a limited life expectancy.

When bond issues were passed to open vocational programs the larger and more expensive pieces of equipment were provided for in the bond funds. Such pieces may each cost from $25,000 to $60,000. Now there is no source of finance for replacement of such costly machinery. In some cases machines are obsolete; in other cases the machines work well enough but are far from what is being used in industry in the state-of-the-art operations.

Vocational educators are painfully aware that their equipment needs updating. Each year they ask for money to help replace pieces of equipment only to hear that but a small portion of the money needed is available. Year after year the equipment in many districts slides toward obsolescence. In FY 83 vocational educators of Ohio requested $7,788,000 in supplemental matching money from the state for equipment but received only $2,080,403. This was 27% of the support requested, and schools would have requested more but did not have the matching money.

The same situation is true across the nation. As reported in the March 1983 Pennsylvania Department of Education "Tool and Equipment Inventory", 53% of their equipment was more than ten years old, 25% no longer met current needs, and 77 million dollars was needed to update the equipment. The ratio of dollars needed to dollars received was 13:1.[3]

In the University of Wisconsin report "Equipment Needs in Vocational Education", March 1983, Wisconsin reported that needs were soaring, but local and state resources were shrinking.[10] In the same report Dr. Orville Nelson says that Oklahoma needs 7 million dollars per year but gets half of that amount. New Jersey educators requested $80 million for secondary vocational equipment in 1982 and got $17 million. Michigan supplied half of the money requested in 1982.

In the Council of Vocational Educators "Position Paper", May 1983, it is reported that Texas needed 10 million dollars a year but is only granting one-fourth of that. Maine reports vocational equipment as being 8 to 20 years old. In this same paper Dr. Nelson of Wisconsin is quoted as saying, "The unibody construction of automobiles has rendered obsolete over 35,000 auto body shops and their mechanics around the country".[1] Only four auto body vocational shops in Ohio have the benches needed for such work.

Also in the same position paper it is quoted that "in the business and office area, 32.9 percent of tools and equipment was reported as being more than ten years old. . . . At the other extreme, the trade and industry area was reported to have 52.5% of its tools and equipment over ten years of age. . . . The percentage of out-of-date equipment, based on dollar value, ranges from a high of 30.4 percent for trade and industrial education programs to a low of 20.5 percent for consumer and home economics programs".[1]

A CHANGING ECONOMIC ERA

General Evidences

We have plummeted into a changing economic era in the last fifteen years and we seem to be at a loss on how to handle it. For many centuries man was in the agricultural-handicraft age and even the switch from stone tools to metal tools didn't radically change agriculture or handicrafting. As the Industrial Revolution progressed in the late nineteenth century some very great changes started taking place in educating the workforce. The apprentice programs which had begun in the Middle Ages melded into on-the-job training and accentuated the need for more education. As the Industrial-Scientific Age evolved after World War II, education in general, and occupational and vocational training in particular, took on new significance. Many persons were still trained on the job. Now we have moved, in just a few years, into a new, complex, and to some, a bewildering age. We have moved from an industrial production economy into a service economy. That is why in this study we speak of the "changing economy" rather than a less inclusive "technological age", or "age of communication". Even though employment forecasters look askance at "futurists" as sensational journalists, let us take a look at what scholars of our day say about the present and the future.

Alvin Toffler says in his book The Third Wave, "A new civilization is emerging in our lives and blind men everywhere are trying to suppress it. This new civilization brings with it new family styles; changing ways of working, loving and living; a new economy; new political conflicts; and beyond this a new consciousness as well. Pieces of this new civilization exist today. Millions are already attuning their lives to the rhythms of tomorrow. Others, terrified of the future, are engaged in a desperate, futile flight into the past and are trying to restore the dying world that gave them birth.[12]

Yoneji Masuda reports in The Information Society as Post-Industrial Society "Mankind is now entering a period of transformation from an industrial society to an information society. . . . Man is now standing at the threshold of a period of innovation in a new societal technology, quite unlike any of the past. Its substance is information which is invisible. This new societal technology will bring about societal transformation which, in a double sense, is unprecedented."[8]

In Location of High Technology Firms and Regional Economic Development, the Joint Economic Committee of Congress says, "High technology industries consist of heterogeneious collections of firms that share several attributes. First, the firms are labor intensive. . . . Second, the industries are science based. . . . Third, R and D inputs are much more important to the successful operation . . . ."[6]

The Ohio Board of Regents' Task Force on High Technology defines high technology as ". . . processes, products and applications stemming from the latest scientific and technical development; utilization of high levels of artificial or machine intelligence capacities through the use of computer technology and the application of sophisticated physical principles".

In the December 5, 1983 issue of "U.S. News and World Report", Melvin W. Siegel is reported as saying, "Technology is changing the computer from a fantastically fast calculating machine to a device that can see,touch, smell, recognize spoken commands and answer in plain English." He says that we have been investigating computer techniques to produce artificial-intelligence (AI) for nearly 25 years. The U.S.A. and Japan are in a struggle for supremacy in the field. In the article cited above we are told, "A recent report by the National Research Council declared that AI 'would affect the circumstances of human life profoundly. It would surely create a new economics, a new sociology and a new history'."

It should be noted, however, that even though high technology is labor intensive and has high visibility, employment in the field is but a small slice of employment.

Finally, John Naisbitt says in Megatrends: Ten New Directions Transforming our Lives that "We are changing economies and haven't changed economies for a hundred and fifty years. . . . We have got to make uncertainty our friend. . . . We are shifting to a new economy that rests on information and electronics. This is not going to happen tomorrow; it is happening today. We are more in the new economy than we are in the old economy". He says that we are in a period of "parenthesis" between the two ages. He writes, "The telephone, computer and television have merged into an integrated communication system which will fuel the information society the way energy -- electric, oil, nuclear -- kept the industrial society humming, and the way natural power -- wind, water and brute force -- sustained agricultural society." He estimates that 75% of all workers will need computer skills by 1990.[9]

Why do we use these quotations? To establish the fact that we are definitely in a changing age. Yes, basic agricultural, handicraft, office and industrial skills will continue to be used, but there is more to consider. For instance, agriculture will persist in Ohio but only 2% of our people will be farmers while 20% of our people will serve the food chain in other capacities. Our students will need most of the basic learning and skills we are now teaching, but the areas of opportunity for work are changing. By 1990 the number of factory workers in the United States will not show much, if any growth, although the number of service workers will rise dramatically.[4]

Although a number of the following areas should be reserved for post high school programs, a University of Wisconsin study names these technologies as new and deserving of educational notice; energy, conservation, generation and alternate forms of energy, robotics, micro-processing, word processing, laser technology, fiber optics, computer assisted design, computer assisted manufacturing, electro-mechanical.[10]

It behooves teachers, counselors, administrators, students, advisory committees and the rest of us to be cognizant of the great shifts taking place in this changing age. Take time to study such publications as Non-Agricultural Wage and Salary Employment, 1980-1990, The Ohio State University, sponsored by the Ohio Occupational Information Coordinating Committee.[7] Two concepts should draw continuing attention: 1) work force needs are changing, 2) salary levels vary from one area of work to another, and persons shifting from one to another area of work will not necessarily find the salary to be higher; it may even be lower.

These concerns loom large when it is realized that in Ohio vocational and technical school programs, there are annually nearly one-half million students and adults in some kind of job training, using the equipment we are discussing. The U.S. Department of Labor reports 16.5 million persons enrolled in public vocational education programs in 1979-1980.[2] Employment matters should be studied in detail, and to that end the following quotations may serve to arouse your interest.

In the Ohio Non-Agricultural and Salary Employment, 1980-1990 report we find that ". . . growth in the manufacturing sector will be minimal"and that ". . . the Ohio manufacturing sector should generate a slight positive increase in jobs over 1979 levels." It also tells us that between 1980 and 1990 health technologists and professional nurses will increase by 35% and licensed practical nurses by 40%; that computer programmers will increase by 24% and systems analysts by 20%. In the same report it is stated, "About two-thirds of job growth will be in the broadly defined service industries: that is, in transportation, utilities, wholesale and retail trade, finance and personal services. . . . The health sector . . . will generate the largest increase. . . . The second largest activity . . . is eating and drinking places.... Business services should increase by 33% . . . and general merchandising stores by 29,000 jobs."[7] Therefore, when we think of curriculum, programming and new equipment, shifts in employment should be kept in mind.

Future Perspectives for Ohio

The Department of Development of the State of Ohio has recently made available its working draft of the first of a series of four publications concerning Ohio's economy. It is called Toward a Working Ohio, Jobs and Ohio's Economy.[4] Selected information is quoted and ideas contained in it are reported.

The general purpose in the report is stated as follows: "The goal of Ohio's strategic planning process is to . . . focus attention on where we want to go, and how we can most effectively get there." It states that "Ohio's publicly funded education programs -- elementary, secondary, vocational and higher -- are an integral part of our investment in human resources. They are also essential elements in our efforts to revitalize Ohio's economic base and to create jobs for our citizens. . . . Strategic planning . . . recognizes that if Ohio is going to continue to spend over 40% of its fiscal resources to educate our children and to prepare Ohioans for tomorrow's jobs, we need to know more about the skills that will prepare our children for future jobs."[4]

Vocational educators and advisory committees will want to study the following statement toward resolution. "While the terms 'comprehensive' and 'employer linkages' have been used frequently to describe the purposes of employment and training programs, Ohio's publicly-sponsored training programs have been highly segmented

and have operated apart from business and industry needs."[4] It is quite apparent that it will take an effective partnership among planners, trainers and employers to keep Ohio's economy in a leadership position. Mr. Alfred S. Dietzel, Director of the Department of Development, advises that the second publication "Human Resources in Ohio" should be studied in this connection.

One of the fears of the Department is a lack of industries with jobs to absorb the work force being trained. In the United States, quite different from most countries of the world, a person chooses the kind of work he or she would like to do and then trains for it. (In many countries the government dictates the training.) This means that meaningful facts and figures need to be at hand for counseling purposes. If we get significant imbalances between the workers needed in Ohio and the workers trained in Ohio, the out-migration fears of the Department may come true. The report says "this out-migration will be heaviest among younger workers, and those with well-developed skills. Unskilled workers will tend to remain in Ohio since their employment opportunities elsewhere are limited. . . . The United States is a mobile nation, and new job opportunities can bring people back to Ohio."[4]

No doubt many people realize the need for a close relationship between training and the practical matter of employment in Ohio. The report states that "skilled workers . . . (are) one of Ohio's major assets, and it is a resource with which this state established itself as an economic leader. But the needs of business are changing - Ohio's economy is becoming more diversified, and our workforce must keep pace with the times." To show some of that change we quote, "The last decade has been marked by a decline in the number of jobs in all goods-producing sectors: agriculture, mining, construction and manufacturing. In total they have dropped to 1.3 million, or 30% of all jobs." By sectors, between 1970 and 1990, manufacturing jobs will drop from 1,403,801 to 1,044,481; but services will rise from 282,496 to 984,013.[4]

The Department of Development states that . . . "an overwhelming majority of job gains come from the birth or expansion of instate firms. . . . Only by maintaining and expanding the wealth generated by the goods-producing industries can we have the resources needed to sustain growth in the service sector. . . . Small business of less than 100 employees will generate in excess of 60% of the net new jobs in the 1980's and 1990's."[4]

EQUIPMENT USED IN EXEMPLARY PROGRAMS

General Information

Thus far we have tried to point out that vocational school equipment in Ohio needs to be updated to meet present and future needs. We have also tried to make plain that even though much of the present education and training will continue to serve needs, we have a phenomenon upon us which we call a changing economic era which will continuously dictate up-dating.

Curriculum development in vocational schools, or vocational efforts in comprehensive school districts, must receive continuing study. Societal needs should dictate curriculum; curriculum should dictate programs which result from consultation with business and industry; and programs should dictate equipment as decided upon by educators and advisory or craft committees. Curriculum and program planning should take into consideration ideas presented earlier in this study.

The following part of the report presents findings from our study of the 57 selected exemplary programs, covering 19 major vocational areas, as found in 41 school districts. In each of the 19 program areas one set of equipment found in a school is listed. It is hoped that general readers will view the lists as bases for understanding the vastness of equipment needs. Vocational educators, on the other hand, will probably use each list as a reference to the local program. These lists of equipment are not theoretical lists, but represent equipment now in use in a very good program in an Ohio school.

It is recognized that some vocational educators may feel that we should have included other program areas, and some may feel that we included some which should not have been included. Variations in kinds of laboratories and equipment needed are great among the vast array of vocational offerings.

Laboratories and shops are simulated world-of-work places within the school. Some students serve in world-of-work cooperative programs held in actual places of work out in business or industrial facilities. We have chosen to describe equipment used in programs having laboratories or shops within the school.

All programs visited, or brought to attention toward consideration, are to be commended for leadership in the various vocational areas. Many programs suggested for visitation, but not on the visitation list, may have as good or better equipment than those listed, but the study had to be kept within workable bounds, and an effort was made to be representative of Ohio. It is requested that the reader substitute in his or her thinking "or equivalent" for the various pieces of equipment as the lists are studied. All lists are reported as they were furnished.

One of the most difficult tasks of making this report was to choose a representative program together with the list of its equipment to be included for each of the 19 programs. Some sets of equipment in programs studied were equal; sometimes equipment in the three programs studied was not too exemplary; sometimes the business community of the region influenced the kind of equipment found in the shop or laboratory; in other instances, program emphases varied markedly. It is definitely not advised that other programs in Ohio should have equipment exactly as listed. Needs of communities vary; strengths of teachers vary; available space varies; financial resources vary; philosophies and goals vary.

Hand tools or equipment with a purchase price of three hundred dollars or less are not listed. Admittedly, in some programs such equipment is a major cost and is dealt with in the comments. Installation and maintenance of equipment are often large concerns in financing vocational education. These matters are addressed to some degree in the comments.

During the visitations, the long-established truth that "the teacher makes the difference" was illustrated over and over again. No matter how fine the equipment, the power of effectiveness in the course lies with the teacher. In fact, in a few instances it was not evident in the equipment why the program had been suggested for visitation. The dynamic of the teacher had drawn the attention. Effective teachers generally had readily at hand an outline of the course of study which made clear their efforts.

If the Advisory Committee member, the Board of Education member, or the Legislator who reads this grasps the enormous equipment use and the directions in equipment need, the value of this section will have been worthwhile. Any one Joint Vocational School or any one larger comprehensive school district has invested millions of dollars in equipment. It is not uncommon for a district to speak of five to ten million dollars worth of equipment. Schools struggle to keep it up-to-date and to keep it repaired. Some districts are more fortunate than others in passage of operating levies. Three districts were identified which, most fortunately, have certain amounts of capital invested in Improvement Funds, the proceeds of which help to obtain equipment each year.

There are hundreds of programs in the taxonomies for vocational education as listed by the Ohio Division of Vocational Education. The following nineteen program area listings are typical of those areas of training where equipment is a critical aspect of the program and provide a fair sampling of the Ohio vocational effort. The portion in each presentation labeled "needed" states the teacher's opinion of what equipment is still needed to bring the laboratory or shop equipment up to adequacy or to the state of the art. Please remember that you are looking at some of the best inventories; the worst would make sad reading.

"Comments" found after each list of equipment were generated from teachers and administrators. In developing new curriculum, however, which requires certain equipment, there ought to be a rather complete curriculum study and review process, and equipment should be chosen in keeping with those results.

ILLUSTRATIVE EQUIPMENT IN SELECTED AREAS

ACCOUNTING

Equipment	Make or Model	Equipment	Make or Model
13 Electric typewriters	IBM 845,885,721	12 Calculators	Olympia CPD4510
6 Electric typewriters	Olympia 45	Calculator	Canon S/ 10
3 Electric typewriters	Royal 5000	Calculator	Sharp QS 1602
1 Electric typewriter	Adler 1030	Keypunch	IBM 029
7 Calculators	Victor 204,332	Verifier	IBM 059
3 Calculators	Casio R 120	Transcriber	Dictaphone 2552
		Transcriber	Lanier American
		Computer terminal	Digital VT100
		Printer	Diablo 630
		Telephones	Comm. Systems

Needed:

4 Microcomputers for providing experience on tr[illegible], to reinforce junior year students' concepts in basic accounting and to teach basic programming on the senior level. Telephone line to computer center. Calculator replacements. Some of the machines listed are not considered up-to-date by the school. In following lists there are also such pieces of equipment.

Comments:

The cost of the equipment now in use is $28,041.

Accounting equipment and practices varied greatly in schools visited. In one school, accounting was taught in conjunction with other business office education courses. One school wants to obtain computers for all accounting procedures. One department is connected to a mainframe computer: one has a digital printer connected to two terminals.

Please remember that in the business office programs discussed, no furniture or landscaping is mentioned. Desks and chairs wear out or need to be changed. The cost of a desk is about $300 and a chair about $100. About 25 of each are needed for a class.

Ninety adults per year are trained, or retrained, on the accounting equipment listed above. This means that approximately 140 persons use it during the school year. This exemplifies why school equipment needs repair and wears out. Data comparable to this could be repeated concerning equipment use in many programs, but will not be in the interest of conserving space.

AGRICULTURAL MECHANICS

Equipment	Make or Model	Equipment	Make or Model
Exhaust system	Custom overhead	4 ton floor jack	Hein Warner
Crane and hoist	Overhead	2 ton floor jack	Hein Warner
Fork lift	Custom built	Portable Crane	OTC
2 Chain hoists	Elephant	Pressure washer	Mercury
Floor grinder	Balor	Dynamometer	MW
Drill press	Wilton	AC-DC welder	Miller
Bench grinder	Balder	AC Welder	Lincoln
Floor grinder	Ingersol Rand	AC Welder	Miller
Drill press	Sun	Valve refacer	Sioux
2 Band saws	Wells	Valve set grinder	Sioux
8 vises	Columbian	Valve set grinder	Black & Decker
Large vise	Columbian	Valve spring tester	Rimoc
50 ton press	OTC	Tractor splitting stands	
Arbor press	Drake	Hydro-sluth	
10 ton floor jack	NAPA	Hydro test equipment	Owatona
Hydro test guages	Nuday	Electrical tuneup	Kal
Injector tester	Backrock	Gear puller	Proto
3/4" Socket set	SK	Gas engine	MF

Needed:

Nothing listed.

Comments:

The senior agriculture mechanics equipment listed above cost $32,920. The replacement cost for the same equipment would be $41,975, or 28% more.

A small engine program is carried on in the same large shop, the equipment of which has a value of $14,060. Juniors take the small engine course and seniors may go into agricultural mechanics (equipment listed above) or into one of two other programs. Patronage work is done in both junior and senior agricultural mechanics courses. A number of agricultural mechanics programs have separate junior and senior shops.

There are differences in philosophies and teaching modes in agricultural and auto mechanics shops. Some instructors believe school-owned engines and equipment should be used in the learning process, while others believe doing customer service work is the more meaningful way to learn. Others use a combination of the two.

Most of the agricultural mechanics equipment observed was purchased in the late 60s or early 70s. The list above was purchased between the early 70s and 1983.

AGRICULTURAL PRODUCTION

Equipment	Make or Model	Equipment	Make or Model
Tilting arbor saw	Powermatic 68	Chain hoist	Cyclone S
Jointer	Powermatic 50	Power washer	Andersons Pump
Band saw	Powermatic 43	Compressor 5 HP	DeVilbiss 378
Drill press	Powermatic 1200	Soil grinder	W-W 3-14-4E
Grinder 5 HP	Baldor 478	Trac.split.stand	Allis Chalmers
Arc Welder	Hobart TR 250	Radial arm saw	DeWalt 3436
TiG Welder	Hobart CT 200	Tractor	Allis Chal. D-19
Oxyaceteline Welder	Purox 201	Arc welder	Hobart TC 295
Metal shear	Edwards 2		

Needed:

Dynamometer to test horse power on tractors and a computer for computer literacy training, and to teach farm applications.

Comments:

The equipment listed above cost $19,940. As in most programs, there are many small tools, benches, cabinets, etc. which are not listed. Estimated annual cost of small equipment is about $800.

Agricultural production shops are not at all extensively equipped. The emphasis is on production, so seeds, fertilizer, tillage, animal husbandry and other topics are studied. Some give more time to machinery care or construction of farm equipment than others. Greenhouses provide plant growth demonstration areas in some schools.

A number of agricultural production programs were visited wherein the students, under the teacher's direction, farm school-owned farms. The students devote a certain number of days each summer to the operation and do the necessary farm work during the school year.

The equipment listed above is, on an average, only about five years old but most agricultural vocational shops have been in existence a long while and have equipment of much earlier vintage. Some of the older basic equipment, however, can serve well as long as kept in repair or until parts can no longer be obtained.

A Production program was visited which had a portable livestock scale, and another one which had a weigh scale gravity bed wagon for field-checking yields of grain. The programs generally reflect community interests and needs.

AUTO BODY

Equipment	Make or Model	Equipment	Make or Model
Dedicated bench system	Blackhawk	Bumper air lift	Walker J 197
Power washer	Regal	Paint booth	Flanagan & Nist
Body repair system	Blackhawk 93052	Power lift	Globe
Floor rail system	Custom built	Porto power 2 ton/pump	Blackhawk FC300L
Wet-dry vac	Huntington 100N	Porto power	Blackhawk FC3T
Bay lift	Walker J 96	Porto power 4 ton/pump	Blackhawk AZ300L
Collision repair system	Buske 418	Porto power	Blackhawk AZ3T
Damage dozer	Blackhawk EK 61	Porto power 10 ton/pump	Blackhawk FZ3T
Paint shaker	Red Devil 5100	Porto power	Blackhawk FZ300L
Body dozer	Blackhawk EK21	2 ton floor jack	Walker J 132
Wire welder	Miller Matic 353	4 ton floor jack	Walker J 134
Wire welder	Miller Matic 200	Ratchet/Socket set	SK 5500A
Arc welder	Lincoln AC 225S	Crane	Red Arrow A 900

Needed:

3 wire welders, plastic welder, diagnostic measuring accessories, 6 sets of jigs for the dedicated bench.

Comments:

The cost of equipment on hand is $43,076 and the needed equipment would cost $33,200. If the present equipment were to be bought today it would cost $75,158. Auto body shops are presently in the state of critical change. Unit body cars have no frame, as in the old sense, but are totally welded bodies, the lower pan of which is especially designed for strength and is made of high tensile alloyed steels and acts as the frame. Once the under part of the unit body is bent it must be brought back into shape with only a tolerance of 3 millimeters (less than the thickness of two dimes). Further, the unit body metals are so alloyed and tempered that they cannot be heated when being repaired, for they would lose their strengths. Therefore, a regular welding apparatus cannot be used for making a repair. A special welder must be used that will affect the weld in an instant without heating the surrounding metal.

Many of the outer body parts are made of plastics. This requires plastic welding. Aluminum is also used in later model cars so aluminum working and welding tools are necessary. Certain cars are made with metrically measured parts, which require the use of metric tools.

To the best of our knowledge only four vocational auto body shops in Ohio have dedicated benches to straighten the later model car frames, although a number of other shops are in the process of getting one or are hoping to get one. Such a bench with needed jigs and accessories costs between $32,000 and $48,000. Within five years mostly unit body cars will be coming in for repair. Some auto body teachers tell us that they can straighten unit body frames with present equipment, but say that much more time is needed for the job.

Because of the above reasons, the modern vocational auto body shops have full schedules of adult classes. Automobile dealerships are interested in training their mechanics to fully service unit body cars.

AUTO MECHANICS

Equipment	Make or Model	Equipment	Make or Model
Engine analyzer	Sun EET-947	Ruger hoist	Ruger
Alignment center	Hunter	3 Engines	2 Pontiac, 1 Ford
Mobile brake shop	Ammco 40B	Suntest Machine	Suntest Vat 40
Hot tank	Kansas Instruments	Suntest Machine	Suntest Vat 504
Transmission Jack	Walker J 47	Hydraulic service jack	Walker 93657
Solvent tank	Kleer Flo R24	Tire changer	Coats 20-20A
Steam jenny	Jenny 200L-GF5	3 hoist-lifts	Globe-single Post
Valve repacer	Black and Decker 6305	Hydraulic press 50 ton	Blackhawk 67615
Wheel spinner & strobe	Hunter EA	Chassis lubrigun	Lincoln 917
Glass head machine	Dreitzler DM-20	Power Washer	Regal
Drill press	Rockwell 15-497	30 gal. pump tank	823-2901
Lubrication system	Coen Oil	Valve shop	Sioux
2 hoists	Globe-single posts	Computer Eliminator	Mac OTC
Hoist	Globe-twin posts	Power drive impact	Proto Bd. 173SS
Chain hoist & trolley	Chester 17	Handle & Extension Set Proto Bd.	54 ASP
Sockets	Proto Bd. 54 SP	Metric sockets	Proto Bd. 52M-SS
Metric open end wrenches	Proto Bd. 12 M-SS		

Needed:

Computer wheel balancer, engine anlyzer for late model cars, adapter for aligning four-wheel drive vehicles.

Comments:

The present equipment cost $60,522 and that needed would cost $17,000. Replacement costs would be much higher.

The equipment listed above tells the story of what is needed to service both earlier cars and the later cars. Some cars have ignition and fuel systems with computer command controls; transmissions necessitate different kinds of lifts; wheel alignment and balancing varies; there are both drum and disc brakes.

Keeping up on mechanical and electronic changes in cars is a major concern of teachers. Before the recent recession, automobile companies provided training for teachers and often provided parts or engines. Presently they do not provide such services. Teachers cannot afford to pay for updating training nor can they be gone for long periods of time. The proliferation of new types of parts in cars requires so many concepts and skills to be taught that enough time to teach it all is a problem.

CHILD CARE

Equipment	Make or Model	Equipment	Make or Model
Piano	Everett 459	Swing TP	Childscapes 5140
Tire raft	Childscapes M690	Refrigerator	GE GG619062-11
Lab storage system	Mutschler	Typewriter	Olympia SGE-A62
Projector-16mm	Singer 1115A	Dishwasher	GE GSD900
Washer	GE WWA8350V	Range	GE JBP 26W

Needed:

Computer to be used for pre-school learning activities, after school learning activities for older youth, inventories, business records and customer billing. Indoor garden and fountain for science and nature projects.

Comments:

Each child care facility has many thousands of dollars worth of small equipment and toys, the like of which are not listed above because of the $300 limitation. Child care toys and equipment must be very sturdy and as safe as possible. Department store equipment will not do: tricycles are heavily made; wood blocks and toys are of solid hardwood with beveled edges; all moving equipment is of such weight and texture as to not harm the children. There are also consumable items needed which cost thousands of dollars per year.

Some of the more expensive items in the laboratory are not deemed equipment because they are built in: a sound system with permanent, distributed microphones; an observation booth with one-way glass and other furniture and equipment; built in counters, cupboards and storage; one-way window overseeing the playground; a planning room with various kinds of furniture to prepare for activites and for art work. Snacks are prepared and eaten; special quiet time equipment is needed; bathroom facilities are sized for tots.

Inventory lists run some four pages and include many children's books, rhythm instruments, live animal facilities, cots, and much more.

Some programs are strictly scheduled as child care centers, while others take on the day care mode. Still others accommodate infant care. Some schools offer adult child care training programs.

COOPERATIVE OFFICE EDUCATION (COE)

Equipment	Make or Model	Equipment	Make or Model
8 Typewriters	Royal 5000	2 Typewriters	IBM Selectric III
2 Typewriters	Royal 970	Typewriter	IBM Selectric
4 Typewriters	Olivetti L 90	8 Typewriters	IBM Selectric II
Typewriter	Olivetti, Editor 5	Typewriter	IBM 60
Typewriter	IBM 85	2 Typewriters	Royal Textwriter
Wireless Lab Earmark, 4 channel			

Needed:

6 microcomputers, 6 word processors, 13 calculators, 14 voice transcribers, 1 copier, 6 electronic typewriters. Some of the items listed as needed are available to the class on a very limited basis in other departments, but for initial training and for sufficient practice these items should be at hand, the teacher believes.

Comments:

The cost of the equipment listed above is $12,883. Interestingly, the replacement cost would not be much greater, but an upgraded laboratory would have the additional cost of the "needed" items, costing about $41,000. It should be noted that less typewriters would be needed if the microcomputers and the word processors were purchased.

Most of the equipment viewed in COE programs is of mid 1970s vintage, which means that there will soon be a lot of replacement.

In most cases the equipment is good, but aging. The older it gets, the higher are the maintenance costs.

COSMETOLOGY

Equipment	Make or Model	Equipment	Make or Model
2 Typewriters	IBM Selectric II	Vacuum	Clark
2 Hydraulic chairs	582-30 Belvedere	Reception Desk	B 19 B4
2 Dryer chairs	213-810 First Lady	Hydraulic chair	611-30 Belvedere
2 Lounges, facial	717 Belvedere		

Note: Each cosmetology laboratory generally has 24 hair dressing stations at 6 islands, 4 stations each.

Needed:

Additional mannequins for instruction and a hot water retaining tank and pump to assure continuous hot water.

Comments:

The above list of equipment does not start to tell the story. There is much equipment which costs less than $300 each. One school, not sure how to tell the story, presented their 8 page inventory list.

In general, junior year cosmetology students learn basics and practice on mannequins. Senior students service patrons in addition to their studies. In the instance of the school whose equipment is listed, there were two junior and two senior classes. This program is very popular. It is reported by the schools that turrover in the field is great, that there is expanding need for cosmetologists and that placement is high.

All cosmetology laboratories must meet State Board of Cosmetology standards and thus have much the same kinds of equipment. Most completers take, and pass, the State board examinations.

Much more is entailed than just beautifying hair; tinting is a large field of study; skin care is learned; styling is learned; and many more scientific and managerial aspects are studied.

Quite often service to public patronage furnishes enough income to pay for on-going expenses.

DATA PROCESSING

Equipment	Make or Model	Equipment	Make or Model
Mainframe mini computer	NCR 8200	2 microcomputers	IBM PC
Terminal	ADDS Viewpoint	Printer	IBM 8CRS
2 Data entry	TAB 702	Mainframe mini com.	IBM 34
4 Display stations	IBM 5252	7 microcomputers	Radio Shack TRS - 80 Model 3
4 Data entry	IBM 3742	4 microcomputers	Radio Shack 2 disk
Microcomputer	IBM 5110	Printer	Radio Shack

Needed:

Tele-communications system

Comments:

The cost of the equipment listed above was $146,061. It would cost less today because micro and mini computers are generally lower in price than when some of these were purchased in the '70s.

There are quite some differences in makes and models of equipment found in data processing programs. In the above list there are no typewriters. Some programs list many: the newer the program, the less typewriters and the more microcomputers. One supervisor stated that if the program were totally reconstituted there would be no mainframe computer, but that microcomputers would be networked.

It is reported by most schools that a high percentage (20 to 60%) of data processing students proceed to post high school education.

Many adults take training on this equipment.

The availability of software which is compatible with the equipment is vitally important and often greatly influences which equipment is purchased.

DRAFTING

Equipment	Make or Model	Equipment	Make or Model
Plotter	HP 7580 B	Printer	Okidata 84P
20 mg. hard disc subsystem	Victor	3 Digitizers	Houston Inst. DT 11
3 256K disk storage	Victor 9121	CAD softwear	Auto-cad
256K hard, drive disk storage	Victor 8121	4 CRT desks	Tiffiny Ty 3060 CS
3 Touchpens	Sunflex for Victor	6 Blue print Mach.	Bruning 148
Transit	Dietzgen Theodolite	26 Drafting tables	Hamilton 3' x 5'
6 track type drafting machines	Muton LY		

Needed:

Processor to network all terminals together which would then allow students to work while the printer and plotter function. In-put could be by touch pen, key board or digitizer tablet.

Comments:

The present equipment cost was $46,365.

Most drafting teachers agree that students need to learn all basics of drafting on the board. A few programs, as the one listed above, have gotten into computer assisted drafting. It has been stated that within five years most of the drafting in larger professional shops will be done by computer. The electronic equipment is expensive (the basic components above cost $27,832) so schools will probably move into this slowly.

One program visited has a programmable drafting machine. In talking with persons from industry we find that it may be good for a job-entry student to know about the machine, but that experienced draftsmen are assigned to operate it.

ELECTRICITY

Equipment	Make or Model	Equipment	Make or Model
12 Power supplies & meters	Lab Volt AA 748 and AA 760	6 circuit trainers	Hampden ACC100, ACUA 100, HMD 100 PPC-AC, ACUM, DM 100, DCUA, HMD 100-PC-DC
10 Component boards	Lab Volt	16 motor control stations with motors	Various Mfgs.
DC motor trainer & accessories	Hampden	Residential wiring mock-up	Custom built
6 Oscilloscopes	Leader Lb 0507A		

Needed:

Solid state motor control, high intensity light and laser generation control, residential wiring components, commercial components.

Comments:

The cost of the equipment listed is $10,475 and the needed equipment would cost $57,500.

The above equipment is used in an Industrial Electricity program. Residential electricity programs would not have this much equipment. In the latter program, basics of electricity would be taught, hands on experience would be provided, and quite often, the senior class would do the electrical work on a house built by the construction trades class.

ELECTRONICS

Equipment	Make or Model	Equipment	Make or Model
12 Workbenches		24 tool kits	JTK - 8
12 Fet Multimeters	Hickok	12 H19 terminals	Zenith
12 Power supplies	Hickok	Printer	Base Z
12 Digital voltmeters	Simpson	3 8-bit micros	North Star
4 Level II micros	Radio Shack	14 Ho Automations	Tyco
Printer, dot matrix	IDS Corp.	14 Logic probes	LP1
14 Digital designers	EL Instrument	12 Oscilloscopes	Hitachi
12 Protobard Kits	EL Instrument	12 Microprocessor trainers	SD Sales
12 Solder stations	Welfar	Printer	Transtar
100 Mitz Oscope	Hitachi	2-6800 trainers	Heath
CPU mainframe	Imsai	2 computers	Zenith
Z 100 computer	Zenith	2 robots	Rhino
Logic analyzer	B & K	Plotter	Bouch & Lomb

Needed:

Automation line to teach automation techniques.

Comments:

The cost of the above equipment was $62,993 and the needed equipment, with installation, would be $18,000.

Electronics is a rapidly expanding area. Not only are the electronics of radio, appliances and televison being taught, but the new electronic area encompassing computers also falls in this field. One school which was visited has an electronics program in which the seniors may specialize in computer repair.

Post high school technical students and college engineering students often come out of these classes. A number of schools reported that 35 to 50% of these students take advanced work.

FOOD SERVICE

Equipment	Make or Model	Equipment	Make or Model
4 Cash registers	NCR 2135	Dishwasher with booster heater	Hatco Hobart AM12
Dishwasher with tables	Hobart C44	Chef's unit microwave oven	Hobart M310T
Cafeteria Lines	Shelley FW36	2 ranges	Vulcan 7860TA
Roll thru refrigerator	Hobart ED 2S	Fry top ranges	Vulcan 7860A
Vertical cutter mixer	Hobart VCM 40E	Broiler	Vulcan 7840AL
3 compartment sink	Hobart FD 200	2 Fryers & fry mate	Vulcan VF 90
Steam jacketed kettle	Groen TDB 7	Convection oven	Vulcan
Shakemaker	Sweden Freezer 1-263A3	Deck oven	Vulcan 7098AZ
Slicer	Hobart 1712	Convection steamer	Cleveland 2DQTG
30 quart mixer	Hobart D 300	Disposal	Hobart FD 150
Convection oven	Vulcan ET 8	Refrig/freezer	Hobart HS2
2 Gas ranges	Vulcan 7845-A	Pan rack	Cres-Cor E12
Steam cooker	Cleveland 2JG, 4PS	Ice cuber	Manitowoc 200
Stack ovens	Vulcan 7000 A1	Slicer	Hobart 1712
3 Fryers & fry mates	Vulcan VF1	30 qt. mixer	Hobart D 300
60 qt. mixer	Hobart H 600	Food scales	Hobart 45-1050
Walk-in cooler/freezer	Kitcheneering	Ice cream cabinet	Kelvinator [illegible]JF
Cook tables	Kitcheneering	Salad/dessert case	Delfield V15272
Salad table		Sal./sandwich unit	Delfield V18460
Tilting braising pan	Groen FPC	Waitress station	Delfield V18460-32
Bakers table	Kitcheneering	Coffee brewer	Bunn-O-Matic
Bakers pan table	Kitcheneering	2 compartment sink	Kitcheneering
Walk-in cooler/freezer	Kitcheneering	Disposer	Hobart F 150
3 compartment sink	Kitcheneering	Hot food cart	Lakeside
Work table	Kitcheneering	Cash register	NCR 225
Salad table	Kitcheneering	Utility station	Lakeside 659
Bakers table	Kitcheneering	Proffer cabinet	Cres-Cor 120PH
Iced cart	Lakeside	Disposer	Hobart F 150

Needed:

Another microwave oven.

Comments:

Most of the equipment listed above was bought in 1979, with a few pieces obtained the two following years, at a cost of $149,752. Presently the same equipment would cost $193,298, or 29% more. It is evident why school districts carefully weigh the merits of having a food service program.

Most of the programs visited have very pleasant dining areas where senior class students serve faculty members, guests and patrons on a scheduled basis. At some schools parking areas are indicated for food service and cosmetology patrons.

Vocational class numbers are limited by regulation generally to 24 or less. It is worrisome to school officials if foods service enrollment numbers are down. Some foods service facilities are used by adult classes in after-school hours.

GRAPHIC ARTS

Equipment	Make or Model	Equipment	Make or Model
Offset press	Davidson 702P	Offset press	AB Dick 350-440753
Roll converter	RC 6111	Dry spray with compressor	
Color head	T 51	Camera	Loge 500
Offset press	AB Dick M360CD	Sharpshooter	Carlson EC 12D
Offset press	AB Dick 360CD-203582		
Copier	AB Dick 990	PMT diffusion processor	Gavert CP 15
Headliner	Compugraphic 7200	Film dryer	South Bend
Sorter	Bin 120	Plate finishing table	RUB 54
Paper cutter	HT 1506	Plate maker	FT 40L
Drill	Challenge 32187 TF	Line up table	Nu Arc RR31
Jogger	Syntron	Headliner	Compugraphic 7200
Collator	Central Binding	Light tables	Hamilton
Folder	Center Graphic	Photo typesetting AM Varityper	AM 5404
Stitcher	Hnee Favorite	Reader head	AM International
Folder	Baum	Computer	
Perferator	Nygren Dahly 20"	Processor	
Thermograver	MBM 7	Desk metic II	Mayline
25 drawer cabinet	Foster	Temperature control sink	TC 24 HFDSV24TC

Needed:

None

Comments:

The above equipment was purchased in 1982 at a cost of $151,339. Most of the equipment seen on visitations was bought between 1965 and 1978. Some shops are well equipped. Some shops visited had only basic equipment, some of which was quite old. There are many directions opening to the trade: new types of printing, artistic design, complex picture reproduction, processing of color film, electronic typesetting, layout work, platemaking, color reproduction, and more.

The employment rate is high in this burgeoning industry. Some of the completers proceed to post high school training.

MACHINE SHOP

Equipment	Make or Model	Equipment	Make or Model
Lathe, engine	Leblond, Regal	Horizontal mill	Cincinnati 205
Chuck, lathe	Leblond 10" Indep.	Drill press, radial	Cincin. Gilbert
Chuck, lathe	Leblond 10" Univ.	Lathe, engine	Doall 15x30
2 Digital readout	Mitutoyo SBN	2 lathe, engine	Doall 15x40
Die head	Enco 72851	Lathe, bench	Hardinge
2 vise, angle lock	Doall-Milling	Surface grinder	Harig
Cutter insert mill	Doall 8" NC 6	Surface grinder	Gallmeyer& Livingston
3 Chuck lathe	Rhon 8" Di-4	2 surface grinders	K.O. Lee
Head-boring	Enco 50 taper SH	Tool & cutter grinder	K.O. Lee 2060
Table, index spacer	Universal 200	Pedistal grinder	Baldor
Cut off machine	Motch-Merriweather	Lathe, engine	Leblond 12x30
Grinder, carbide tool	Standard Electric	Boring and turning	Woton-Werkel
2 Lathe, engine	Leblond Makino	Bandsaw, vertical	Doall 1612
Flexowriter	Friden 2308	Horizontal mill	Millwaukee MDLH
Digital readout system	Quality 500	Vertical mill	Bridgeport BRCJ
Micrometer set	Starrett	Drill press	Rockwell
Lathe, engine	Southbend	2 Grinder, belt	Sunstrand
Drill press	Powermatic	Table mill	Thompson TC 100
Drill press	Rockwell	EDM machine	Excello-Electra
Drill press	Burgmaster	Lathe, gear head	Doall 1550
Vertical mill, 1½ hp.	Bridgeport BRZJ	Grinder	Myford 10185
2 vertical mill, 1 hp.	Bridgeport BRJ	Comparitor, optical	Scherr Tumico
Vertical mill control	Bridgeport 550GE	2 Hardness tester RC	Goko Seiki
Tank solvent clearner	Gray Mills	Bandsaw	Rockwell 20"
Grinder	Baldor	Drill sharpener	Darex
2 Dividing head	Yuasa-Inter.	Machine CNC	Emco-Compact
Furnace heat treat	Electra	Grinding attachment	Doall
Bandsaw	Wellsaw	Power hacksaw	Keller HDS

Needed:

Computer operated turning lathe, CNC, and a computer operated mill, vertical CNC. The cost of these two pieces would be $110,000.

Comments:

This was the most extensively equipped machine shop viewed. Most shops visited had some aging equipment and some which was inoperable because it needed repair or because parts could no longer be found. Machine shop equipment is expensive as illustrated by the above equipment which cost $235,724. If bought today, like equipment would cost $388,787, or 65% more than original cost. Educators agree that vocational students must learn basics on present types of machinery but that students need to be introduced to Computer Assisted Design (CAD), Computer Assisted Manufacturing (CAM) and to Computer Numeric Controls (CNC). (CONTINUED ON NEXT PAGE)

We were told during the 1983 Ohio Vocational Association convention that Japan can manufacture heavy machinery at about half the cost of American made machinery because their factories are automated with programmable machines and robots in a continuous, automated production line. It was stated that such a 1.5 million square foot manufacturing plant is being built in Kentucky and that a few dozen operators and a few hundred technicians will run the plant. Presently it would take toward four thousand workers to produce a similar amount of product. This helps to explain why about the same number of workers, or a diminished number, will be needed in the future in manufacturing.

We are told that the recent recession caused a glut of machine operators, but that there will be a large need for them by 1990 when present workers retire. Job entry workers generally begin in small or medium size shops. Industrialists emphasized the need for beginning machine operators to be able to read blueprints well.

MERCHANDISING

Equipment	Make or Model	Equipment	Make or Model
Island unit	Kidde	Cash register	Victor 939183
Cash register	Data Term 219/18	Cash register	Electronic Reg.
Typewriter	IBM Selectric	Marker-Pricer	Monarch 145
Display wall hang rod	Kidde Merch. Eq.	Cash register	NCR
Sign press	Kidde Merch. Eq.	Cash register	NCR 250
Display unit 5x15 w/glass	Ges Store	Cash register	EMS 107469
Typewriter	IBM Selectric	Cash register	EMS

Needed:

A microcomputer for inventory, accounting, and payroll simulation.

Comments:

The equipment listed above cost $19,976. Replacement costs would be about 20% higher, and some computer equipment would be added.

There are many specialties taught in the various programs within the general area of merchandising and, therefore, many lists of equipment which emphasize those programs could be furnished. We mention a few examples of merchandising programs: general merchandising, grocery store merchandising, warehouse merchandising. There are many other examples and each requires its own type of equipment.

Some general merchandising programs were visited which had only a classroom with a typewriter or two, a cash register, a display case and a display window. In other cases the merchandising class operated a full-blown school store with all display cases, shelving and sales equipment.

STENOGRAPHY

Equipment	Make or Model	Equipment	Make or Model
Shorthand		11 Transcribers	Dictaphone 2880
Wireless lab	EFI	4 Electronic type.	IBM 60
Spirit duplicator	Heyer	2 Memory type.	IBM 100
5 Transcribers	Dictaphone 241	2 Word Processors	Apple 2 E
20 Typewriters	IBM Selectric	Word Processor	Apple 3
Thermofax copier	3M	Printer	Diablo 630
		Mimeograph	Gestetner 420

Needed:

12 Word Processors to provide more hands-on experience; 9 transcribers so each student could have one; 6 letter quality printers so one would be available for each 2 Word Processors; a photocopier to provide training in reduction, enlargement and collation; 6 electronic typewriters to provide more hands-on experience. The cost of these items would be $68,025 plus another $13,500 for accessories and software.

Comments:

The cost of the equipment now in use totals $60,400.

As in data and word processing, students must have good academic potential to be successful. It is reported that not as many proceed immediately for further training, as compared to data and word processing, but that experienced adults take advanced training so they can proceed into management.

There are very few mechanical typewriters found in business office education classes. Some teachers say they will buy no more electric typewriters but instead will buy only electronic typewriters. Others go the full way and say they will buy no more typewriters and will purchase only computers.

WELDING

Equipment	Make or Model	Equipment	Make or Model
7 welders	Hobart RCC-450-RUS	3 welders	Lincoln DC 600-LN 8WF
Welder	Lincoln 250-250 TIG	Welder	Lincoln DC 600-LN 9WF
Welder	Miller 330 TIG	Welder	Lincoln DC 600-LN 9WF

Note: New overhead electrical service serves this equipment, and new booths and benches are well positioned on wall sides of the room. A new electronic precipitating ventilation system is also in process of being installed.

Needed:

None was named because the equipment above is new.

Comments:

The cost of the above equipment was $49,285. Many items of under $300 value are also found in the shop. 60 adults use this equipment for training purposes each year. The shop is in use an average of ten hours per day.

As metal alloying changes, as new metals are to be welded and as plastics become pronounced in fabrication, the kinds of welding equipment and materials change.

Many of the welding shops are crowded because they have limited space. Often aging equipment is found in welding shops. One program studied was very effective, but the equipment was mostly old.

Teachers agree that all basics of welding must first be learned. Most have juniors do practice welding. Some provide seniors with extensive fabrication welding. Power access and proper ventilation are big items in setting up the welding shop. Some teachers expressed the idea that welding could be a one-year course: that credit could be given for competencies and when those are met, full credit could be given.

WORD PROCESSING

Equipment	Make or Model	Equipment	Make or Model
2 Typewriters	IBM Standard	2 Textwriters	Royal SE 6000
4 Typewriters	IBM Selectric	2 Textwriters	AB Dick Magna II
12 Typewriters	IBM Selectric II	Word processor	Royal Textwriter
3 Typewriters	IBM Selectric III	Mag card	IBM System 6
4 Typewriters	Olympia Electric III	14 Transcribers	Dictaphone
Electronic Typewriter	IBM 60	Listening lab	Electro System
3 Electronic Typewriters	IBM 75	Telephone system	Telex
		13 Transcribers	Lanier

Needed:

25 Word Processors and printers to train students to use CRT (Cathode Ray Tube) screen and to understand the capabilities of a word processor. These would cost about $6,000 each, for a total cost of $150,000.

Comments:

The equipment listed above cost $80,362.

In the above listing it is quite evident that there is a deficiency in the number of word processors. This helps to point up the fact that even in some of the best programs there is not enough money to acquire what is needed. For example, in another school 3 IBM Displaywriters and 3 Exxon 500 Word Processors were found, but other equipment was hardly comparable. We could have broken our pattern of review and have gone to a school with more exemplary equipment, but thought it not wise. The equipment listed as "needed" would provide state-of-the-art equipment.

Many students proceed from these courses to post high school training or education. One school district reported 85% of the data processing students proceed to postsecondary education.

The number of adults trained on this equipment is high. Interestingly, it is reported that youth pick up the training on new technology equipment much faster than adults.

GENERALIZATIONS AND CONCLUSIONS

Viewpoint

The visitation person who is author of this report, spent more than 40 years in education and helped to establish a total vocational education program in a large city. It is hoped that all who read this report will join in the view that what is reported is a part of the whole effort in education. No part can stand alone. There is a strong case for vocational and technical education, as there is a strong case for college preparation. All educators should help students pursue their interests toward a satisfying career through whichever educational route is taken. Many more people will work in the service oriented part of our economy than in one of the professions, but some may very well approach a place of leadership or a profession through vocational or technical high school experiences.

After spending nearly thirty days and traveling more than 3,000 miles to view vocational equipment in 41 school districts, with concentration on 19 different programs, the following conclusions are made.

General Condition of Equipment

The status of equipment varies school by school and often program by program. Some schools evidence much need for help to procure more and better equipment, however, a few schools had very good equipment.

Where levies have been passed recently, school districts have been enabled to purchase much of the needed equipment. Some districts were affluent enough to provide most of the needed equipment. A few districts had Improvement Funds, the interest of which could be used for equipment, and therefore had quite good to excellent equipment throughout the school.

The greatest need for equipment was found in smaller vocational districts, generally where they have had the most trouble passing levies. Much need was also found in large city districts where large pockets of economic, social and educational overburden existed. Most other districts had pronounced needs for upgrading equipment and/or for help with procuring the more expensive pieces of equipment.

There were two major areas of need for equipment replacement: 1) More expensive equipment which is out-of-date or worn out, or which is needed because of new developments, and 2) equipment to meet the needs of changing technologies. Both of these needs call for state of the art equipment which is generally quite expensive.

There is a real concern in the less well equipped districts that if equipment used in vocational courses does not keep up with that used in homes and in the better offices and shops, students will be less enthusiastic about taking vocational education.

Cost of Equipment

The costs of equipment vary greatly but are generally high. The range reported in the cost of present equipment for a single program was $10,475 to $235,724. Current prices for this equipment would be much higher. It should be understood that equipment costing less than $300 per item was not included. In some programs there were many such items.

Suggestions were made for additional needed equipment in almost all of the programs. The costs of this equipment ranged upward to $150,000 per program.

The total investment of the vocational equipment in the schools studied was reported generally to be in the range of five to ten million dollars per school district.

Installation and accessory costs are often important to planning and purchasing of state of the art equipment. This is especially true in office courses when new electric service must be provided, or when new climatic controls must be obtained. It is also a major consideration in auto body, auto mechanics, agricultural mechanics, machine shop, or welding when new electrical service, new foundations for machines, or new exhaust systems become mandatory.

Assessment labs have been established in a number of schools and have been found to be very valuable. Comprehensive school districts as well as vocational districts feel the need for them. It may be logical to direct counseling efforts into the assessment and prescription modes of operation. This would necessitate definite equipment and software costs.

Districts that have the most difficulty obtaining equipment because of deficient finances also have the most problem getting state supplemental financing for equipment because they do not have the matching money. Approximately three times the present amount of state money is needed annually for supplementary equipment to accomplish the upgrading of vocational equipment. In the FY 1982-83 vocational educators in Ohio requested $7,788,000 but received reimbursement of only $2,080,403 due to lack of additional funds at the state level.

Equipment to Serve the Handicapped

Equipment to serve academically and physically handicapped students is of concern. Some schools have laboratories in which they can teach such students single skills. Other schools see a real need for such laboratories. In other situations support for equipment is needed in mainstreaming these students at the rate of 2 to 6 in regular vocational classes.

Equipment from Business and Industry

Quite a number of pieces of equipment found in vocational programs are from business or industry which has loaned or given the equipment to the school. It is generally equipment which no longer will be used by the company but which may still be in good condition. As long as such equipment remains in use in job entry types of offices or shops, it remains of value in the school program. The equipment has been greatly appreciated. Such equipment should be studied continuously to ascertain its viability.

Efficient Use of Equipment

Vocational educators believe it is important to use equipment efficiently. In some cases educators want more flexibility in programs so achievement can be competency based, rather than time based. If certain students could learn a skill in one-half the allotted time, it would free the equipment for others to use. Some students need more time for academic courses. Therefore, a movement is under way to provide for flexibilities which will accommodate efficiencies and provide time for other needed learning.

In many instances more adults than secondary students use the equipment. One joint vocational school reported 12,000 adults annually in classes. Another larger district, having a number of campuses, accommodates 35,000 adults. Large cities accommodate many thousands annually.

Computers and Sophisticated Equipment

The use of computers is very much in evidence in many of the programs, as in the business office programs. They are also coming into prominent use in such areas as electronics and drafting, and are used as supporting tools in all other programs. They are increasingly changing the role of the teacher to a manager of learning. Some schools have computer literacy programs, while others are hoping to obtain the equipment to start them.

Many of the vocational areas are becoming more sophisticated and more technically oriented. Business office programs fall into this classification as well as agricultural mechanics, auto mechanics, electronics and drafting. Consequently, these programs need sophisticated electronic equipment. Computers are replacing typewriters and calculators; light beams and sophisticated electronics are used in auto mechanics; computer assisted drafting is making great strides.

Greater Need for More Basics

Equipment quite often can serve only as well as the operator understands the equipment, its functions and its product. In all vocational areas basic understandings of mathematics and science are essential, and in the more sophisticated operations knowledge of advanced mathematics and science is essential. The new state standards for graduation, and knowledge needed in technical programs both require mathematical and scientific knowledge beyond what some vocational teachers are able to provide. Hence, related, certificated math (and sometimes science) teachers are being requested. Communications skills are also of deep concern. Less able students are often provided special help in mathematics and language. Advanced help is also needed for the able students. This is less of a problem in comprehensive settings than in full-day vocational settings. Persons from business and industry are vitally concerned about job entry persons, many of whom need to be well rounded in mathematics, science and communication skills.

The skill to operate a machine is often not the determining factor whether a job entry person holds a job. Persons from business and industry expressed strongly in conversations that personal characteristics such as promptness, being on the job every day and being a team person, along with mathematics, science and communication skills were centrally important.

Articulation with Post High Schools

Skill achievement on equipment, and related mathematical and scientific understandings vary greatly among students. Those students who progress beyond their peers are often ready for advanced standing in a post high school institution of learning. There are many such public technical institutions in Ohio. Some secondary schools have articulation agreements with those schools and some are working on such agreements. It is suggested that all schools consider trying to arrive at such agreements.

Advisory Committees

It is generally agreed that vocational advisory or craft committees are essential in the selection of equipment. Such committees of key persons from business and industry can both help to select meaningful and efficient equipment and can help to form an employment bridge for students to become job entry workers.

RECOMMENDATIONS

The following recommendations, based upon the findings in the study, are made for the consideration, and hopefully for implementation, to the personnel of the Ohio Department of Education, Boards of Education, School Administrators, Teachers of Vocational Education and Advisory Committees.

1. Develop policies, procedures and resources to provide, install and maintain state-of-the-art equipment and accessories needed for vocational education, including equipment for assessment laboratories and service to the handicapped.

2. Secure more financial assistance from the State Legislature, through the State Department of Education to support the schools, as needed, in a program of obtaining and installing state-of-the-art equipment and accessories.

3. Make adjustments in the curricula and individual programs to provide needed instruction in the use of computers, and additional instruction in mathematics, science and communications as related to a changing economy and effective use of state-of-the-art equipment.

4. Explore the possibilities of making more flexible and efficient use of equipment through competency based instruction as it serves high school students, and provide through the flexibilities, time needed by certain students to take either remedial instruction in basic learnings, or advanced mathematics, science and communications courses.

5. Promote the development and multiple use of assessment laboratories by related schools.

6. Keep and extend higher enrollment vocational programs and courses to be taught in local high schools; concentrate in vocational schools on programs and equipment which serve more "exotic needs" and which serve areas of study and skills needing enrollment concentration.

7. Encourage both high school and post high school community vocational institutions to put in place plans for articulation between the institutions in the use of facilities and equipment, and to give and accept advanced standing for high achievers.

8. Use advisory committees, including representatives from business and industry, to counsel with school officials and teachers of vocational education in appraising, selecting and using the equipment.

9. Direct a program of inservice education for counselors, teachers and administrators to acquaint them concerning the trends in the economy, job opportunities, the use of technical equipment and curriculum adjustment in the preparation of students for their role in a changing society.

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APPENDIX

School Reporting _____ September 12, 1983 Page 1a

Program Reported _____

Person Reporting _____ EXEMPLARY EQUIPMENT IN OHIO VOCATIONAL PROGRAMS

NOTES:
- One of these forms should be filled out for each exemplary program, as requested in the letter.
- No hand tools or pieces of equipment initially costing less than $300 need to be listed.
- Please list all equipment and machinery regardless of what monies purchased it or from whom it is on loan or by whom it was donated.
- Please place a red X before the name of each piece of equipment which you presently think serves the "state of the art"
- In case of multiple pieces of identical equipment, put the number before the name of the equipment but give all other data on an "each" basis.
- If page 1a does not provide enough lines, continue on page 1b.

Name of Equipment	Make and model of Equipment	Date of Purchase	Acquisition cost of each	Estimated Replacement cost of each	Check one for each machine: State and/or Federal money	local money	loan or donated from industry	Other

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Other needful information:

- Please give an estimated annual cost of hand tools and small equipment for this program _____
- Estimate the number of hours per day this equipment is used by secondary students and adults _____
- How many adults receive initial training per year on this equipment? _____
- How many adults receive retraining per year on this equipment? _____

Please tell us here what pieces of equipment you need to bring your equipment up to the "state of the art" (as defined "up-to-date, current, meeting modern needs")

Piece of Equipment	Need it Would Serve	Approximate Cost	Cost of Installation	Cost of Accessories

Comments you would like to make about any matters of the survey:

Thank you for providing this information.

Please return these forms to L. W. Huber, 4371 Kitzmiller Road, New Albany, OH 43054 (Telephone number) (614) 855-7429 (envelope enclosed)

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